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## ABSTRACT

The small, isolated college has problems with information management, especially with respect to lack of funds and the need to store and retrieve large quantities of information. At Gavilan College, the College Information System (CIS), a terminal oriented data processing system, is proving to be invaluable for maintenance and access to college data bases. CIS has provisions for maintenance of all student information, permanent transcript information, registration for courses, class lists, grade reports, and provides random access to the entire data base for information searches. The low relative price of the small time-sharing system implemented by CIS, coupled with the fact that the system can be utilized by existing staff with only a few hours training under the directions of a trained systems manager, result in the cost of such a system falling within the range of even a small college. A description of the program structure and capabilities is included. (Author/AH)

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## A TERMINAL ORIENTED REGISTRATION AND DATA PROCESSING SYSTEM AT A SMALL COLLEGE

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### INTRODUCTION

Samuel Johnson is credited with the comment: "Sir, a woman preaching is like a dog's walking on his hind legs. It is not done well; but you are surprised to find it done at all." With apologies to Dr. Johnson, one is as surprised to find an interactive, terminal based data system using a mini-computer as to see a dog's walking on his hind legs. One is more surprised to find not only that it is done, but done well.

The purpose of this paper is to describe the characteristics and utilization of CIS (College Information System), a terminal oriented data processing system which is implemented and running on a Hewlett Packard 2000F time sharing system. CIS was developed by Hewlett Packard as part of TOADS (Terminal Oriented Data Systems). Gavilan College acted as a validation site for CIS and assisted in the project. CIS has provisions for maintenance of all student information, permanent transcript information, registration for courses, class lists, grade reports, and provides random access to the entire data base for information searches.

As will be seen, the name "mini-computer" is somewhat misleading as very ambitious tasks are successfully handled. From the financial point of view, such capabilities have usually been far beyond the reach of small colleges. However, the low relative price of small time sharing systems, coupled with the fact that CIS can be utilized by existing staff with a few hours training open new and exciting vistas for maintenance and access to college data bases.

### OVERVIEW OF CIS

#### Philosophical Considerations

Before becoming embroiled in details, it will be wise to pause to consider the philosophical framework in which CIS (as part of TOADS) is embedded. With regard to cost, two characteristics are very important. First, the capabilities of small interactive systems (measured in calculations per unit cost) have been steadily increasing. At the same time, the cost of mass storage devices has been steadily decreasing. This has lead to possibilities which would have been unthinkable a decade ago.

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Traditionally, cards have played a key part in handling of data. CIS represents a marked departure from this concept. The fundamental notion is that the originator of data should enter it into the system. The practical considerations of number of terminals available, and system security cause reality to fall somewhat short of this ideal goal. However, all information is entered into the system and desired output is obtained by a few people with few terminals.

One of the most nagging problems which plagues data systems is the steady, almost cancerous growth of overhead due to personnel required to operate the systems. Only one person with special qualifications is required for CIS. This person is the system manager and is at once system analyst, programmer, and system operator. The staff that actually uses CIS can be the personnel presently working at the college. Experience has shown that only a few hours training is needed to become proficient in the interaction with the system. A final comment is that because of ease of use, administrators and faculty can have personal access to the college data base with resultant improvement in the general decision making process.

#### CIS Program Structure

The College Information System is a collection of BASIC programs. While some may argue that BASIC is an inappropriate language for data processing activities, it has proven to be very suitable in this case for two reasons. First, BASIC allows an interactive time sharing mode of useage which is one of the most valuable characteristics of CIS. Second, program changes are much easier to carry out in an interactive language. The Hewlett Packard 2000F BASIC is a very powerful version and has proven equal to the demanding requirements of data base management. The question of efficiency of BASIC is argumentative. This will be discussed further later in the paper.

The programs comprising CIS are grouped into six functions. The easiest way to get an overall feeling for the capabilities of CIS is to list the programs by function.

#### 1. System Initialization

- a. Check for existance of all files
- b. Student data file conversion
- c. Definition of term names
- d. Student level and academic status definition
- e. Grade table definition

#### 2. System Maintenance

- a. Data base check
- b. Data base fix
- c. File dump

- d. Security update
- e. Data base length assignment
- f. File unlock in case of program error
- g. Data element dictionary update
- h. Edit file update
- i. Display of last transaction by file
- j. Display of data base sizes
- k. Registration and grade reporting term assignment

3. Data Base Update

- a. Student update
- b. Mass transfer of active students
- c. Mass delete of active/inactive students
- d. Course data base initialization
- e. Course data base copy
- f. Course update
- g. Mark of course data base

4. Registration

- a. Schedule of course offerings
- b. Course master list
- c. Closed course list
- d. Sort all classes by instructor
- e. Sort all classes by student
- f. Class lists
- g. Student schedules
- h. Registration

5. Grade Reporting

- a. Grade assignment
- b. Historical grade update
- c. Comment assignment
- d. Missing grade report
- e. Grade verification lists
- f. Final grade reports
- g. Midterm grade reports
- h. Transcript labels
- i. Selected students for grade reports or transcript labels
- j. Grade distribution report
- k. Special grades list

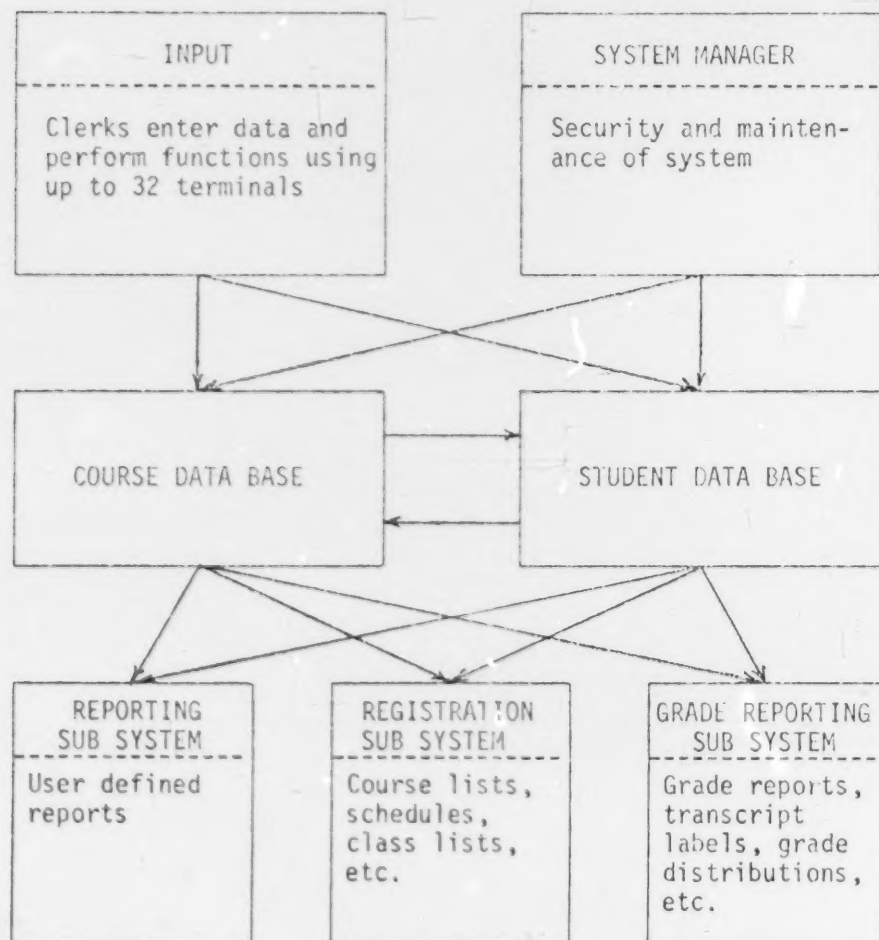
6. User Reports

- a. Query
- b. Sort
- c. Report formatter
- d. Report printer

Each of the programs listed above contains the English instructions "in the clear" permitting secretaries or employees not expert in data processing to use the system. As indicated above however, one well trained staff member is necessary to fulfill the requirements of system manager.

Most of the program categories are self explanatory. The last - User Reports - turns out to be one of the most valuable. Colleges are constantly besieged with requests for a wide variety of information. Using the query facility, a search of the data base can be made using user defined search criteria. The power and usefulness of this capability is obvious to anyone who has spent hours or days digging through records searching for information.

The programs in CIS tie together two main files of information - the student data base and the course data base. The flow of information in the system is indicated in the following chart.



File Organization

All information on students is maintained in random access disc files. Each student is allocated two records (1024 characters) of space in the file. The file contains information on students who have enrolled in the past, those presently enrolled, and those expected to enroll. The active section of the file contains those students presently enrolled. All others are in the inactive or historical section.

The student's social security number is used to key all record transactions. The data maintained for each student has been designed to agree in type and format with the standards specified by NCHEMS (National Center For Higher Education) at WICHE (Western Interstate Commission on Higher Education). This has the obvious advantage that information required for governmental reports, projects, etc., is already in the proper format.

Data Elements

Eighty-four data elements are specified by CIS for each student. These elements can be "turned on or off" as desired. A college can select those elements needed locally and delete the rest. From six to forty-four new elements can be defined by the user depending upon element size. These user defined elements provide a great deal of flexibility permitting CIS to meet special or unique local requirement. The data elements for each student are as follows:

| Element Number | Description                   |
|----------------|-------------------------------|
| 1              | Social Security number        |
| 2              | Name                          |
| 3              | Birthdate                     |
| 4-9            | Address and phone number      |
| 10             | Sex                           |
| 11             | Marital status                |
| 12             | Dependents                    |
| 13             | Citizenship                   |
| 14             | Ethnic information            |
| 15             | Residency information         |
| 16             | Housing                       |
| 17             | Major                         |
| 18             | Advisor                       |
| 19-21          | Student standing and progress |
| 22             | Expected entry term           |
| 23             | Last term registered          |
| 24-25          | Current program status        |
| 26-29          | Status of last grade report   |
| 30-34          | Course credit information     |

|       |                                            |
|-------|--------------------------------------------|
| 35    | Actual entry date                          |
| 36    | Exit date                                  |
| 37-38 | Termination status                         |
| 39-45 | Financial aids information                 |
| 46    | Hours worked                               |
| 47-52 | Reserved for future use                    |
| 53    | Staff ID                                   |
| 54-58 | Veterans and selective service information |
| 59-81 | Information on parents                     |
| 82-84 | Reserved for future use                    |
| 85 On | User defined                               |

### Entry Of Student Information

The application form for admission to the college has all the information required in a format that facilitates entry. The information is typed in at any of the terminals connected to the system. At Gavilan College, experience has shown that it requires about five minutes to enter a student at a terminal assuming reasonable typing skills. Of course several terminals can be active entering students at any given moment. Also, the only skill required is the ability to type. One very attractive way to increase the speed of student entry is through the use of information on forms which can be "page read" by scanners. This newer and faster input mode is presently being developed at Gavilan College.

Using the interactive capability of the system, individual data elements for students are modified as they change. Thus, the student data base is a dynamic collection of facts that changes from hour to hour, and which always provides the most up to date information possible.

### COURSE DATA BASE

#### File Organization

The course information is maintained in the same fashion as student information. Each course being taught is allocated two records (1024 characters) of information in the course data base. All the information needed to uniquely define every course is contained in the data base. Once the complete course data base is established, one of the programs in CIS can be used to prepare a course schedule for reproduction. After the course data base has been used for a given term, the information can be dumped and stored on magnetic tape to form the starting point for the same term the next year. The data base can then be modified as required to account for changes.

An additional file - the courses taken file - contains the list of courses taken by each student for that term. It must be opened to at least half the size of the student master file.

Data Elements

Each of the courses being taught has the following information defined in the course data base:

| Element Number | Description               |
|----------------|---------------------------|
| 1              | Discipline                |
| 2              | Discipline abbreviation   |
| 3              | Course ID                 |
| 4              | Course suffix             |
| 5              | Section                   |
| 6              | Day or night              |
| 7              | Enrollment code           |
| 8              | Course title              |
| 9              | Reserved for future use   |
| 10             | Instruction type          |
| 11             | Ending time               |
| 12             | Beginning time            |
| 13             | Days                      |
| 14             | Building                  |
| 15             | Room                      |
| 16             | Contact hours             |
| 17             | Units                     |
| 18             | Credit equivalent         |
| 19             | Instructor ID             |
| 20             | Instructor                |
| 21             | Lecture equivalent        |
| 22             | Maximum number of seats   |
| 23             | Normal number of seats    |
| 24             | Minimum number of seats   |
| 25             | Actual seating            |
| 26-28          | Footnote information      |
| 29             | Course level              |
| 30             | Special section           |
| 31             | Fees                      |
| 32             | Facilities                |
| 33             | Program ID                |
| 34             | HEGIS code                |
| 35-40          | Team teaching information |
| 41-44          | Reserved for future use   |

Course Capability

The organization of the course files gives a great deal of latitude in course structure. Up to 110 students can be registered in a given section. There can be up to 99 sections of a course. A student may be registered in any section as a standard student, audit, or repeat. The system automatically checks the first five data elements in the course files to prevent duplicate identification of courses.

Up to six terms can be defined for each academic year. If desired, a course file can be established for each of the terms permitting students to register for the entire year at any time. The only limitation in the process is that grade processing must be done in sequence. Winter term, for example, could not be processed prior to the grades for the Fall term.

## RETRIEVING INFORMATION FROM THE DATA BASE

### Standard Reports

Provisions and programs have been provided in CIS to generate the reports usually encountered in a college. These include:

1. List of courses including seat size, seats taken, and average daily attendance.
2. List of all courses closed to further registration.
3. List of classes showing students registered for each class.
4. Schedule for each registered student.
5. List of assigned grades for all classes.
6. Final student grades.
7. Midterm grades.
8. Transcript labels.
9. Distribution of grades.

### Query

The query facility has been included in CIS to permit the user to search the data base with any set of criteria desired. The user has the option of using a query on a course master file, active students or inactive students. Criteria are always specified in the following format:

element operand "value" (connector) element operand ...

The pattern can be repeated up to forty-one times. Element refers to elements in either the student or course data base. Either the element name or number may be used. The operand must be one of the following:

| Operand | Meaning                  |
|---------|--------------------------|
| GT      | Greater than             |
| GE      | Greater than or equal to |
| LT      | Less than                |
| LE      | Less than or equal to    |
| EQ      | Equal to                 |
| NE      | Not equal to             |
| RN      | Inclusive range          |

Value is the value used for selection and must always be enclosed within quotes. The optional connector is either AND or OR.

Examples of typical search criteria and their meanings are given below.

| Criteria                            | Meaning                                                                                              |
|-------------------------------------|------------------------------------------------------------------------------------------------------|
| NAME GT "PECKHAM" AND STATE EQ "CA" | All students with names alphabetically following but not including "PECKHAM" who live in California. |
| 6 EQ "N" AND 14 EQ "HUM"            | All courses meeting at night in the humanities building.                                             |
| 31 GT "000.00" OR 17 GE "5.00"      | All courses/sections charging a fee or with more than 5 units.                                       |

The search criteria serves only to locate student or course records. Using a report formatter, any information in the records may be tabulated and output as desired. The results may also be sent to a work file for retrieval later.

#### TYPICAL CIS INTERACTIONS

##### Logging On And Gaining Access

The user begins by logging on at a terminal using the proper account number. The desired program is retrieved from memory and RUN. Before the clerk or secretary can gain functional access to the program, however, the proper passwords must be furnished. These can be READ ONLY or WRITE passwords and are changed often by the system manager.

In the examples to follow, the initial details of logging in, retrieving the program, furnishing the proper passwords, and initial set up will be deleted. In all cases the operator responses will be underlined to distinguish it from the material typed by the computer. The computer print out and operator responses will be in upper case letters to distinguish it from the explanatory material.

##### Adding A Student To The Student Data Base

```

COMMAND ? //ADD
1. SOC-SEC-NO ? 044240474
2. NAME ? SMITH, JOAN G.
3. BIRTHDATE ? 9/23/50
4. STREET ? 254 MT VIEW RD
5. CITY ? BOONDOCKS
6. STATE ? CA
CODE = CALIFORNIA
7. ZIP ? 95020
8. PHONE ? 4081126087
9. PHONE-EXT ? (cr)

```

10. SEX ? //SKIP  
 TO WHICH ELEMENT ? 22  
 22. EXP-ENT-TERM ? 75-1  
 30. TRANS-CR-COM ? //SKIP  
 TO WHICH ELEMENT ? ALL

TID-AS 799

COMMAND?

In CIS, the double slash (//) signifies a command versus data entry. Elements 1 through 6 are self explanatory. In item 6 the code entered is checked against an edit file to verify accuracy. The corresponding entry is typed back. In element 9 there was no phone extension, so the operator replied with a carriage return which is equivalent to a null response. At element 10 the operator initiated a skip to element number 22. If the operator skips to ALL the transaction is completed. The TID number is a transaction identification number which is recorded by the operator on the source document. In the event of a system failure, the file of TID numbers can be used to build the data files back to current status without loss of any information. Note that the system skipped automatically from element number 22 to 30. This indicates that the intervening elements have been "turned off" and are not in use.

#### Adding A Course To The Course Data Base

COMMAND ? //ADD  
 1. DISCIPLINE ? A14C  
 CODE = THEORETICAL MATHEMATICS  
 3. COURSE ID ? 50  
 4. CRSE-SUFFIX ? (cr)  
 5. SECTION ? 90  
 6. DAY-NIGHT-FG ? N  
 7. ENROLL-CODE ? (cr)  
 8. COURSE-TITLE ? FINITE MATH I  
 10. INSTR-TYPE ? LEC  
 CODE = LECTURE  
 11. END-TIME ? 2000  
 12. BEGIN-TIME ? 1700  
 13. DAYS ? TR  
 14. BUILDING ? MATH  
 15. ROOM ? 325  
 16. CONTACT-HOURS ? 3.0  
 17. UNITS ? 3.00  
 18. CREDIT-EQUIV ? (cr)  
 19. INSTRUCT-ID ? 1  
 CODE = PECKHAM  
 21. INSTR-HOURS ? 3.0  
 22. MAXIMUM-SEAT ? 35  
 23. NORMAL-SEAT ? 30

24. MINIMUM-SEAT ? 15  
25. ACTUAL-SEAT ? //SKIP  
TO WHICH ELEMENT ? ALL

TID-CM 143  
TICKET # IS 1153

COMMAND ?

Several important items are noted on this transaction. In elements 11 and 12, the time is entered in the 2400 hour notation. The abbreviations for the days of the week are M,T,W,R,F,S. The letter R is used for Thursday. D indicates daily. After the TID number has been displayed, the course Ticket Number is typed out. This number is used to identify courses during registration, for course changes, and is part of the schedule of courses.

#### Registering Students

ENTER STUDENT NUMBER ?  
123456789

123-45-6789      DOE, JOHN J      04-08-51

ENTER DATA ?  
461,1165,621,413

TID 2154

ENTER STUDENT NUMBER ?

The computer searches the student data base for the social security number entered. When found, it returns the social security number, name, and birthdate to verify that the correct record has been located. To register the student, the ticket numbers of the desired courses are entered separated by commas. The computer checks for time conflicts and availability of courses. In the instance above, no conflicts or problems were found and the registration was completed as indicated by the TID (transaction identification number). If desired, the operator can append an L on the chain of ticket numbers which causes a complete listing of the student's schedule to be output. If problems occur, courses may be added or deleted at any time using the same program.

#### Entering Class Grades

MODE ? ALL

<< ALL MODE >>

TICKET # ? 19  
POLI S 3984A 10

THERE SHOULD BE 8 STUDENTS ON THE CLASS LIST

|                        |        |
|------------------------|--------|
| 1. ALBOTT, FRANK       | ? C+   |
| 2. ANDERSON, MARY LOIS | ? A-   |
| 3. DOUGLAS, MARTIN     | ? A    |
| 4. GILLET, ALICE ANN   | ? //JU |
| POSITION ? 7           |        |
| 7. SIMPSON JR, GENE    | ? B-   |
| 8. THOMAS, DWIGHT E    | ? //JU |
| POSITION ? 4           |        |
| 4. GILLET, ALICE ANN   | ? B+   |
| 5. MONTOYA, SALLY JANE | ? //FI |

TID-AS 823

TID-CT 955

TICKET # 15

T MAT 0058A 10

THERE SHOULD BE 2 STUDENTS ON THE CLASS LIST

|                      |         |
|----------------------|---------|
| 1. MARTIN, JOAN G    | (AUDIT) |
| 2. MILLER, ANN MARIE | ? A     |

TID-AS 824

TID-CT 956

TICKET #

After the ticket number for the class is entered, the class number and section are returned to verify that the correct course has been located. A check is provided for the number of students in the class. The operator (or the instructor may enter the grades) enters the grades per the prompts. If desired, grades can be entered out of order using the //JU (jump) command. If for some reason, the instructor does not want to enter all the grades at this session at the terminal //FI (finished) is entered. The two TID numbers indicates that the appropriate files have been modified.

In the next transaction (ticket number 15) a grade may not be entered for student #1 since the student is auditing the course. If all the grades are entered for the course, the TID numbers are displayed automatically and the computer waits for the next ticket number.

#### Other CIS Interactions

Only a few of the many possible interactions with CIS have been given here. The purpose has been to illustrate the manner in which information flows into and out of the computer. The complete capability has a very wide range and is discussed fully in the software user's manual.

UNIVERSITY OF CALIF.  
LOS ANGELES

FEB 14 1975

CLEARINGHOUSE FOR  
JUNIOR COLLEGE  
INFORMATION

Hard Copy Not Required

For most of the transactions with CIS, hard copy is not needed. The ideal terminals in this case are any of the wide range of CRT terminals presently available on the market. Their reliability, speed, and silent operation make them very desirable.

Hard Copy Required

If hard copy is required, additional considerations arise. Some of the output (grade reports, class lists, etc.) is extensive. Line printers can be used for this purpose if desired. At Gavilan College the decision was made to use very reliable 30 character per second printing terminals. The lack of speed is compensated for by the fact that several terminals can be working at the same time in different positions in the job giving effective line printer speed. Thus, line printer speed can be obtained when required while retaining the flexibility of individual terminals at other times. The terminals used at Gavilan for this purpose employ the Diablo print wheel and mechanism and have proven very reliable.

BASIC Language And IO Efficiency

As promised, the question of the efficiency of BASIC as a data processing language will be discussed further. This must be done in the context of overall system operation. Experience has shown that the efficiency of the language has very little to do with overall operation of the system. The computer is operated 24 hours a day, 7 days a week. If long or involved computing jobs are required, they are initiated and the clerk or secretary goes on to something else while the job is being done. Due to the time sharing mode of operation, several of these jobs can be running at the same time.

When reliable printing terminals are used, the long printing jobs are started when the employees go home at night. In the morning the copy is removed and it really makes little difference how long it took to complete the job since the computer is running all night in any case. Based on the experience with CIS to date this type of job occurs only several times a term. The vast majority of interactions are short and are accomplished easily during normal working hours.

## CONCLUSION

The problems of information management are not limited to large colleges and universities with expansive computer centers and data processing staffs. The small, isolated college with two to three thousand students has an equal stake in the critical problems of lack of funds, and need for large quantities of information. The